Study of Lighting, Humidity, and Ventilation in RISHA Design at Kampung Deret Petogogan, Jakarta

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Abstract. Kampung Deret Petogogan program is considered successful in changing the face of housing that was previously shabby, neatly arranged with sturdy houses, and housing facilities. Slums are no longer visible in the settlement. Residents now live in a cleaner, neater, and more comfortable environment than before. The government also plans to make the Kampung Deret Petogogan a model for other slums. For this reason, an evaluation is needed whether the housing built with RISHA (Healthy Simple Instant Home) technology has met the health and comfort aspects, including lighting, humidity, and ventilation of a house. The method used in this is an observational study with a qualitative understanding of architectural phenomena in the field based on theoretical knowledge references. Data collection was carried out through direct observation in the field and interviews with the chairman of the community forum *of* Kampung Deret Petogogan. The data obtained is compared with the required criteria related to aspects of lighting, humidity, and ventilation of the dwelling. Field findings show that the design of RISHA in the Kampung Deret Petogogan has not met the health and comfort criteria of a house, as seen from the lack of achievement in design related to lighting, humidity, air circulation, and ventilation. There is a need to adjust the RISHA unit's design to make it a habitable residence that can be applied to other slums.
Keywords: lighting, humidity, ventilation, design, RISHA, Kampung Deret Petogogan

1. Introduction

Slum dwelling is one of the problems facing the city of Jakarta. The problems arise because of the accessibility to adequate housing and infrastructure services, which gradually have formed independent settlement areas with and without legality [1]. The government has made various efforts to overcome this problem, one of which is by providing more suitable housing such as flats. Unfortunately, the implementation of apartments often experiences obstacles due to residents who refuse to be moved for various reasons. Therefore, one of the solutions offered by the government is to revamp houses in slums known as Kampung Deret. One of them is located in RW (Citizens Association) 05, Kelurahan Petogogan, Kebayoran Baru District, and is known by the name Kampung Deret Petogogan (KDP), which means Petogogan Row Village.

The new houses built by the government use the RISHA (Healthy Simple Instant Home) concept stands for *Rumah Instan Sederhana Sehat*, which means Simple Healthy Instant Homes. RISHA is a precast system construction technology for simple buildings or known as *Rumah Sederhana Sehat (RSH)* [2]. RISHA is an innovation in the form of technology design of residential building construction with components that are compact and modular in size and use a knockdown system that can be provided by fabrication [3].

In general, based on an analysis of the satisfaction of respondents with the KDP program, the KDP program was considered a success [4]. The program, which was completed in 2014, is deemed to be successful in creating a new face from areas that previously looked dirty, becoming neatly arranged housing with sturdy houses, widened roads, equipped with water channels, and even there is a park where residents can socialize. Slums are no longer visible in the settlement. Residents now live in a cleaner, neater, and more comfortable environment than before.

Although in physical appearance, housing at Kampung Deret Petogogan has improved, RISHA design needs to be reviewed, which residents occupy whether it has reached the required healthy housing

criteria. Because if the concept applied to the village becomes a solution to the problem of settlements in Jakarta, then, of course, this program can be continued for other slum areas. The government itself wants to make Kampung Deret Petogogan as a model for other row villages [5]. Therefore, this study of RISHA design in Petogogan is needed.

2. Purpose and method

The purpose of this research is to understand qualitatively the design of a Healthy Simple Instant Home (RISHA) built at Kampung Deret Petogogan. The research method used is an observational study that understands qualitatively architectural phenomena in the field based on theoretical knowledge references. Data collection is done by direct observation in the field and interviews as primary data. The interview was conducted with the chairman of the Kampung Deret Petogogan Association to determine the condition of the post-dwelling village series. Whereas the secondary data used was obtained through literature study, in the form of government policies, technical guidelines, news articles, and theory books as references.

3. Results and discussion

For Kampung Deret Petogogan consists of four RT (Neighborhood Association), namely RT 08, RT 10, RT 11, and RT 12, which are located in RW 05 of Kampung Petogogan. The total number of houses included in the Kampung Deret program is 135 houses. There are two types of housing units built with RISHA technology: type 18 and type 36.

Based on observations on modular dwelling units in Kampung Deret Petogogan along with their environment and interview results, the authors found several problems in the design of RISHA dwellings that could affect the health and comfort of the inhabitants, especially at 40 housing units type 36 located in RT 08 and RT 10, among others are as follows;

3.1 Housing layout design

The housing units in KDP are included in the RISHA Maisonet class because they have a height of a row of houses with a height of two floors. But the arrangement of housing units does not have a distance between buildings by the provisions. Each unit should have at least two sides of open space at the back and front of the unit, while the RISHA design on KDP has one side, namely the front only. Besides, the open area in front of the unit should have a free space of at least 6 meters. Whereas in KDP, some units have to deal with walls with a distance of approximately 2-3 meters, namely 20 units in RT 08 and 20 units in RT 10.

It looks different from the units in RT 11, which mostly face the park and RT 12, which faces the open area, although some houses also have units that face about 3 meters. This makes the impression of tightness in some houses, especially in RT 8 and RT 10. Besides, these crowded conditions certainly make it difficult for air circulation and natural lighting along the alley (See Figure 1).

Figure 1. Houses in RT 8 and 10 are facing the wall (left), some houses in RT 12 are facing each other (right), and houses in RT 11 are facing open space
Source: Authors, 2020

3.2 Unit Area

The RISHA design in Kampung Deret Petogogan is mostly typing 36. Type 36 means it has a building area of 36 square meters. Type 36 occupancy means it is intended for a four-person occupancy capacity. This was obtained from the study results that the need for space per person is 9 square meters, with an average height calculation of the ceiling, is 2.80 meters [6]. Ideally, type 36 residential is built on a minimum land area of 60 square meters per unit. Thus each unit is possible to obtain maximum openings both for lighting and ventilation. Even for the row or Maisonet type, it has at least 6 meters of open land on the front and 3 meters on the back.

In the KDP case, each type of 36 units was built on an area of 18 square meters. Of course, this happens due to limited land compared to the population is so dense. Therefore, it is understandable that each unit occupies land only as large as the ground floor of the unit. Unfortunately, this condition seems to be worse because about 1 meter in front of the unit becomes an open terrace, meeting directly with the road without boundaries, while the walls and doors of the unit are behind it. Residents are asked to keep the terrace open, not be insulated so that the terrace area can be a place of circulation. As a result, the functional space of each unit is reduced.

3.3 Unavailability of clothes drying area

KDP residents also complained about the lack of area for drying clothes [7]. People can't hang clothes in the house, because there is no more space inside [8]. Finally, they took the initiative to create a laundry drying area in front of the house, even though these conditions would undoubtedly make a humid airing and could again create a dirty image in Kampung Deret Petogogan.

3.4 Lighting

The only light access for each unit is the open area in front of the house. And indeed, on the RISHA maisonette type, the window is designed only on the front side of the house, as well as in Kampung Deret Petogogan. The houses in KDP itself almost all face north and south, so they will not be exposed to direct sunlight both in the morning and evening. This is not a problem for residents with houses facing the park because they still have a large open space so that it is not prevented from getting natural lighting.

Unfortunately, for houses that face each other, and those facing the wall with a distance of only about 2-3 meters, the distance is so narrow, plus the *overstek* of the roof that protrudes out of the building about 1 meter, certainly makes the window on the 2nd-floor room blocked. Moreover, the opposite wall has a height exceeding the roof canopy of the house in Kampung Deret Petogogan (See Figure 2, 3).

If we follow the rules of a healthy and comfortable home planning, where direct sunlight can enter the room for a minimum of 1 (one) hour every day, this is certainly not possible in 40 houses in RT 08 and RT 10 whose rooms face the wall.

Figure 2, Roof extension that leaves narrow light access
Source: Authors, 2020

Figure 3. The window directly facing the wall
Source: Authors, 2020

Not to mention the room on the 1st floor, where the unit's wall is 1.5 meters further back than the floor above. The room on the 1st floor will certainly never get enough natural lighting with a RISHA

unit design like this (See Figure 4). Moreover, added by people who hang clothes in front of the house, will make this area more closed from access to light. As a result, if the residents want to get enough lighting for their activities, it is always necessary to turn on the lights.

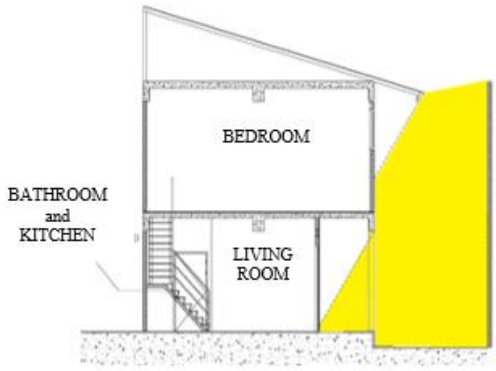

Figure 4. Illustration of direct sunlight at the house
Source: Authors, 2020

The impacts of light on people from different points of view have been investigated by various studies for more than a century. These studies shows that light has both visual and non-visual effects on humans [9]. Poor sunshine and lack of sunlight are said to be responsible for what is known as 'Seasonal Affected Disorder' or SAD, which affects large numbers of people at certain times of the year due to a lack of sunlight [10]. Since the availability of outdoor light affects the incidence of SAD, light can play an important role in preventing and curing SAD [11].

3.5 Humidity

Due to the lack of lighting in the room and the sun area in front of the house, the room's humidity cannot be avoided, especially on the 1st floor. The bathroom located on the 1st floor and behind the unit has no access to sunlight at all (See Figure 5 left). If the back of the housing unit is an open space, it is still possible for the bathroom to always get lighting. However, because the back wall of the house is a direct border with other units, the bathroom ventilation can only be directed into the room. Even in some houses, the bathroom is next to the kitchen under the stairs (See Figure 5 middle, right). The drying area in front of the house, and the bathroom and kitchen located at the back of the house, create an activity room on the first floor flanked by two wet areas so that it becomes humid (See Figure 5).

Figure 5. The bathroom in the corner of the unit (left), the kitchen at the bottom of the stairs, next to the bathroom (middle), and dark atmosphere of the 1st floor (right) that the lights must always be turned on
Source: Authors, 2020

3.6 Air ventilation and circulation

In addition to the window, each unit has a ventilated brick in the form of filigree and is only on the front side of the house. Space conditions like this do not allow the occurrence of cross ventilation. Because cross ventilation can only be formed if the ventilation holes are on different sides or opposite directions, whereas because the housing unit on KDP has only one opening direction, the circulation that occurs is not optimal, it cannot reach to the back of the room, both on the 1st floor and the floor 2.

Not only that, the bathroom and kitchen inside the building without ventilation on the backside also worsen the air conditioning. The ventilation in the bathroom is connected to the middle floor room-1, which is usually used by residents as living room, family room, and dining room, where the main activities in the house are done besides sleeping. In addition to the air from the bathroom and kitchen will fill the room on the 1st floor, according to the principle of stack-effect, hot air will move up because it has a lighter weight than cold air, so that when hot air rises to the top and exits through the air gap at the top, then the air in the room will be replaced with cooler air entering from the slit low [12]. Because it is directly adjacent to the stairs, the heat will move to the 2nd floor so that it comes the sleeping area of the residents of the house. Whereas on the 2nd floor, ventilation is only on the front side, so for heat in the building to get out, of course, it must go through the residents' sleeping areas (See Figure 6).

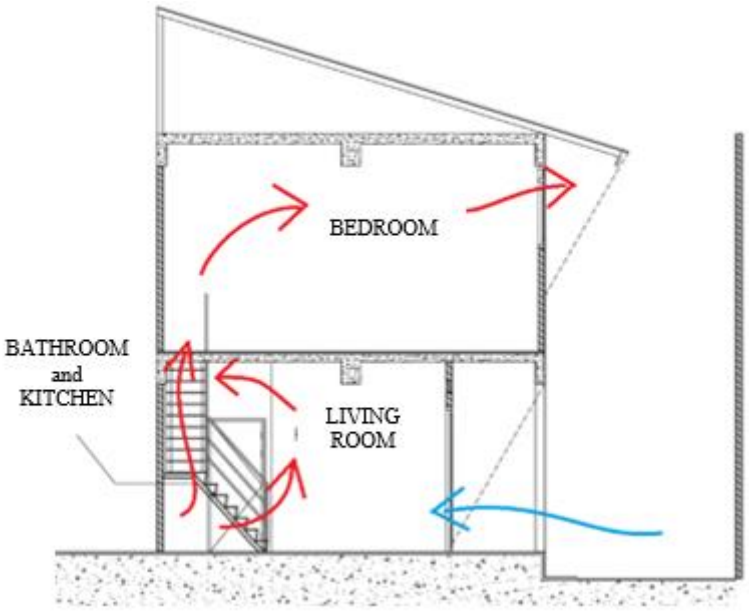

Figure 6. Illustration of air movement due to stack-effect
Source: Authors, 2020

4. Conclusion

Kampung Deret Petogogan was built as a solution to the problem of slums in Jakarta. The aim is to provide more suitable settlements than previous housing. In physical appearance, the houses of residents in the villages in the series have indeed increased. However, based on the results of the study, the RISHA design applied to Kampung Deret Petogogan did not meet the requirements for a simple, healthy, and comfortable home. Problems arising in the RISHA design that are used include inadequate natural lighting, humidity in the room, as well as poor air circulation, and exposure.

It can be understood that the design formed is inseparable from the factor of the dense population of RW 05 Petogogan Area on limited land. Due to lack of land, the RISHA housing units at Kampung Deret Petogogan were forced to close together. The distance between buildings that are too close causes each unit of the house to have only one side of the building that can be used as an opening for natural lighting and air. However, this should not be a reason for not providing adequate housing for residents.

Finding a suitable housing solution in a dense and slums environment is a challenge that architects must solve.

In Kampung Deret Petogogan, some design adjustments are needed to ensure residents can live in homes that meet health and comfort aspects. Design changes are necessary since the RISHA design in the Petogogan Deret Village will be an example for other slums. The author's suggestion, if possible, it is necessary to find another unit's configuration to create more than one side of the opening plane. And if not, then other methods are needed to increase the natural lighting in rooms that do not have windows, namely through upper lighting. It can be considered to create a ventilation hole at the top of the stairs so that air can escape through the back of the unit without the need to pass through the residents' activity area. It can also be considered for each unit to have a balcony roof as a place to dry clothes, given that the RISHA module itself already uses a concrete plate as a cover for the ceiling of the 2nd floor. In addition to opening air ventilation access, the staircase area also has the potential to access light to the ground floor, at least contributing to the back of the house's light.

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